



Prospects for fossil-fuel power generation in Southeast Asia: Where to from here?

The Lantau Group
May 2018

Introduction to The Lantau Group

(Or, why should you listen to me?)

Asian economic and commercial consulting firm specialising in Energy

Energy Economics and Value

Competition, Markets, Regulation, Policy

Decision Support Analyses

Disputes

Market Analysis

Asset Valuation

Strategy and Advanced Analytics

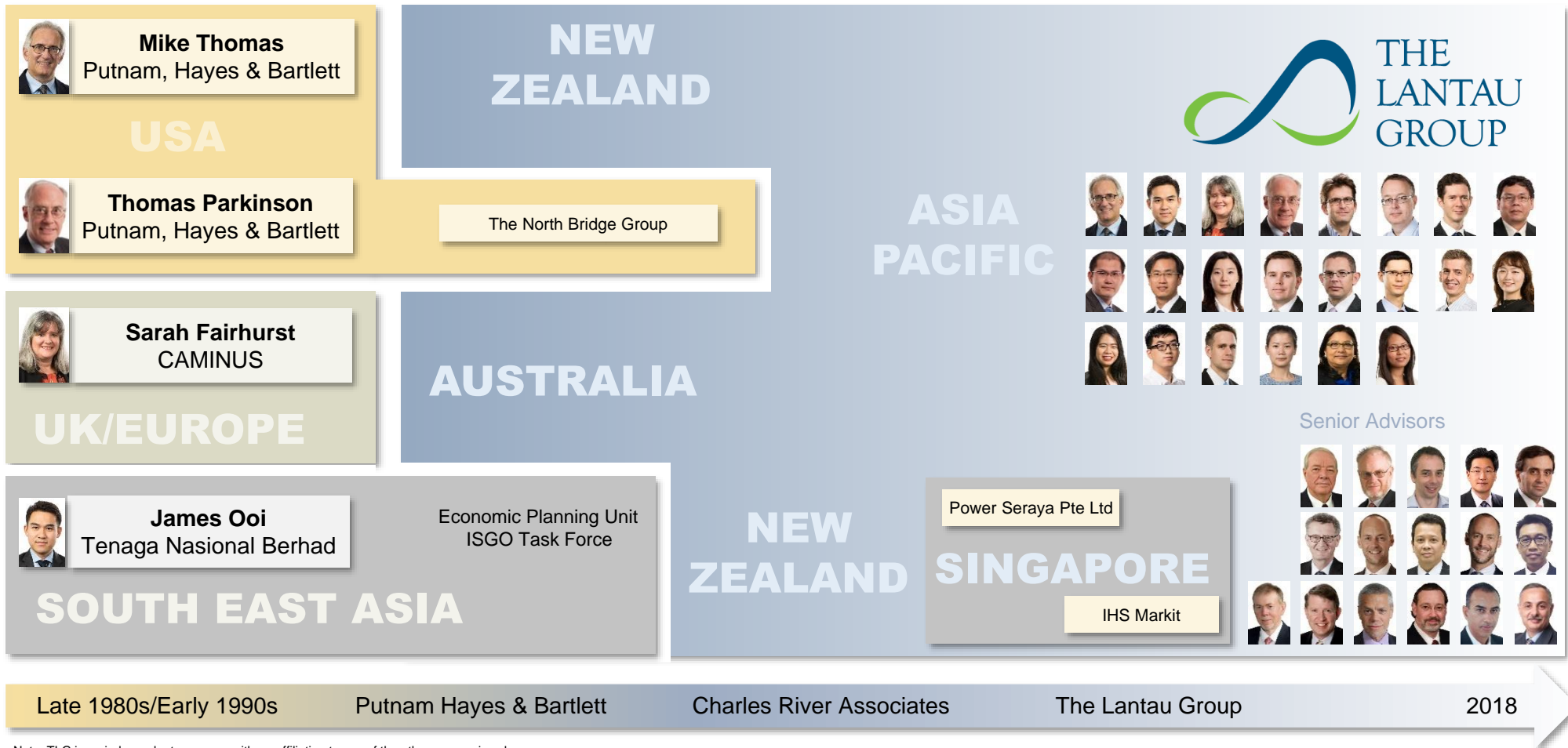
Offerings:

- Strategic, commercial, and regulatory support
- Ability to connect fuel markets and power
- Analysis-based recommendations
- Highly relevant international experience
- Accessible experts focussed on the region
- Pricing, trends, drivers, risks



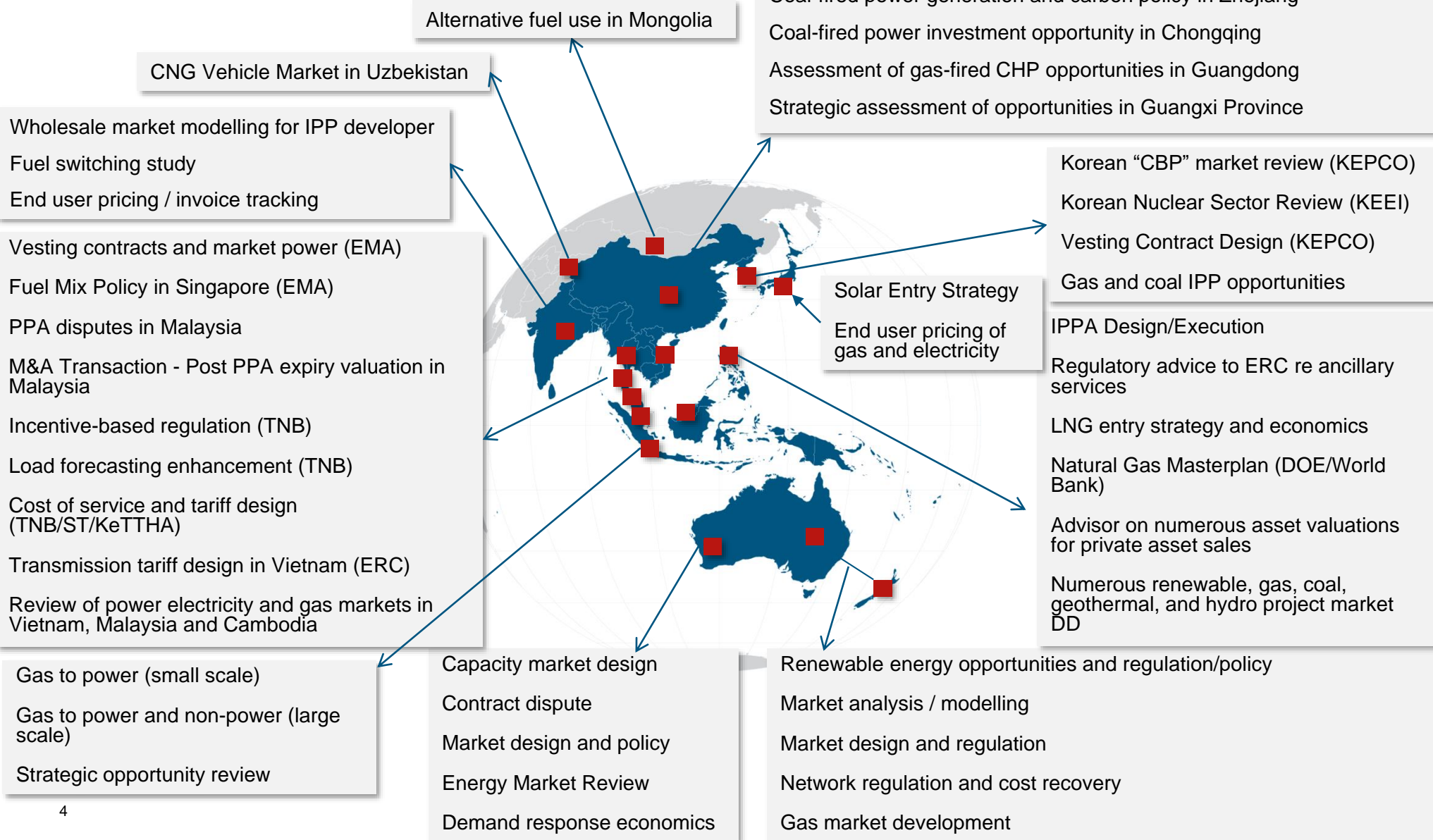
The analysis of power. The power of analysis.

Decades of experience in commercial and regulatory matters across the globe



Deep and Experienced Team

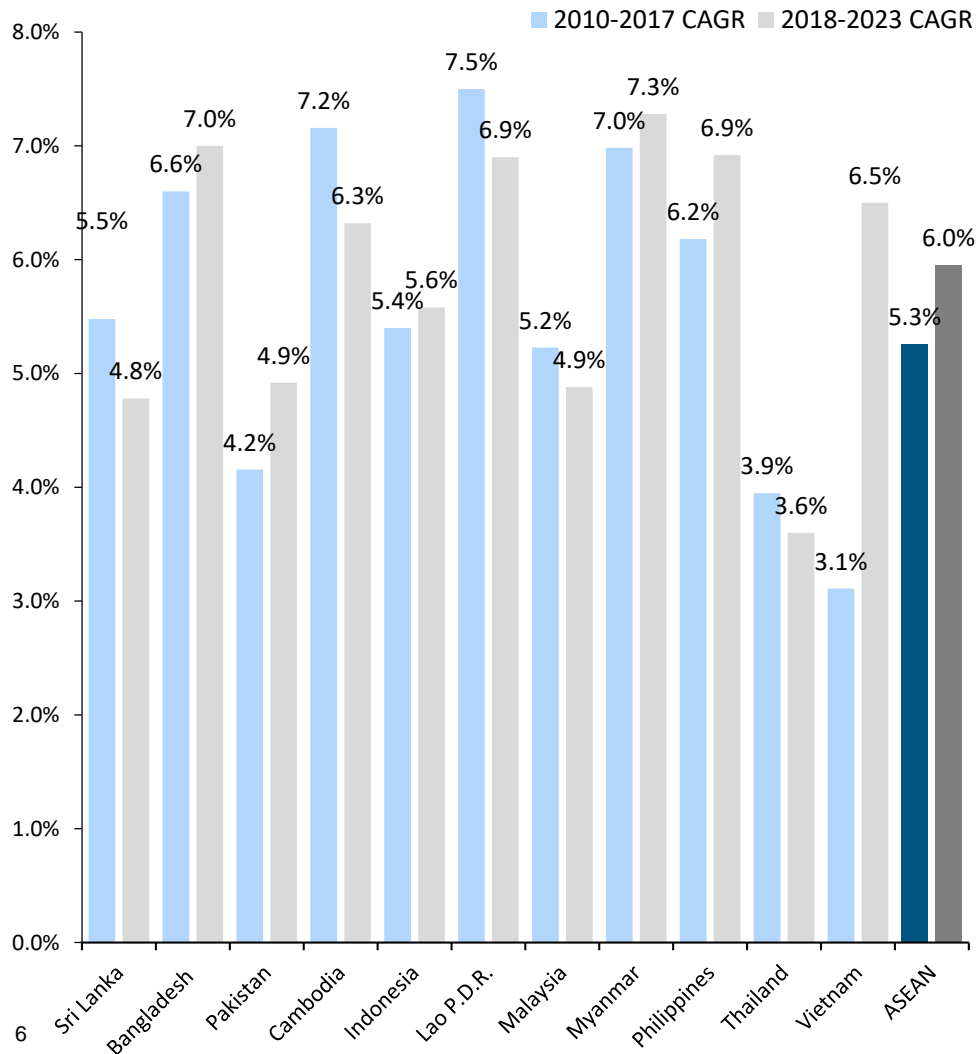
We work on all fuels across all Asian markets



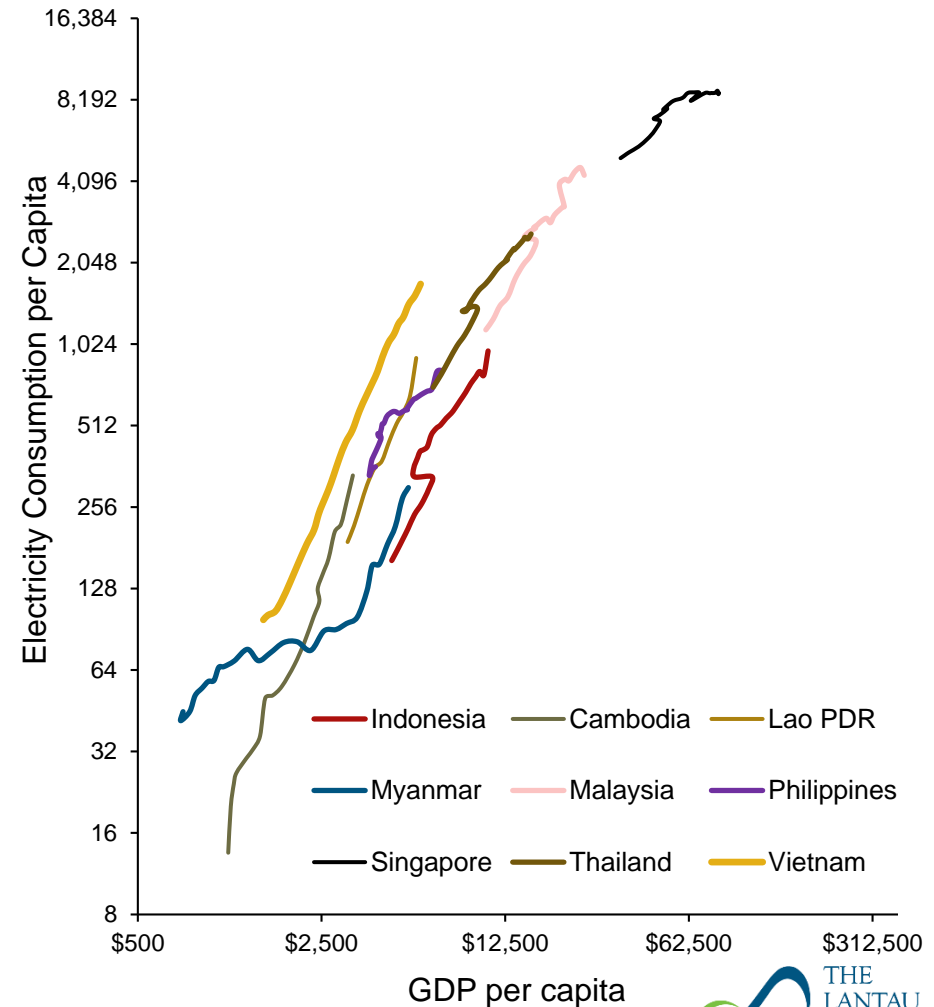
In most of Asia, power demand is still growing rapidly

Robust GDP growth supports energy demand

Real GDP Growth



Electricity Consumption per Capita vs. GDP per Capita (1990 - 2016)

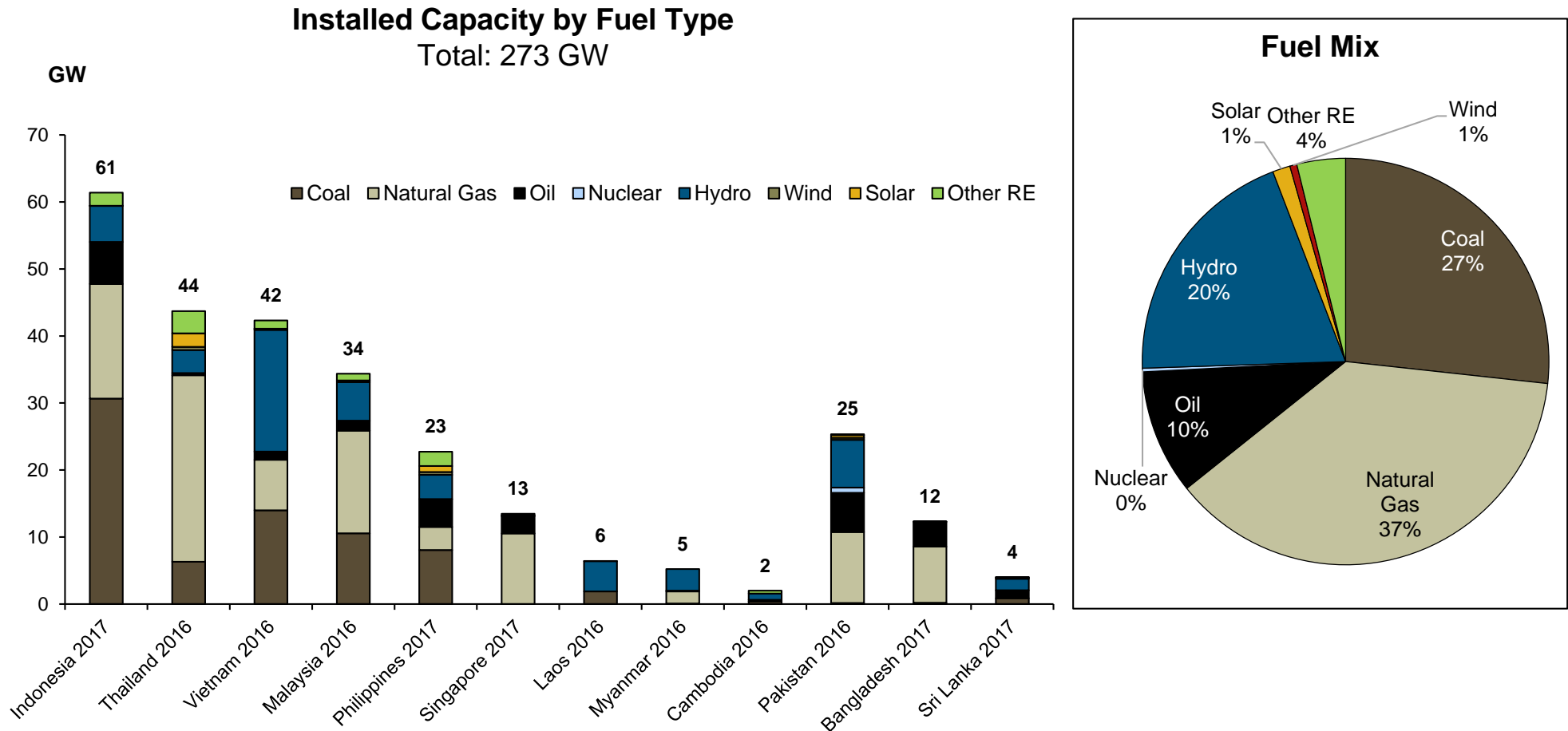


Source: IMF Databank; TLG Analysis

Demand growth will drive almost 200 GW of capacity additions until 2025

The question is – will this demand turn into fossil-fuelled opportunities or renewables?

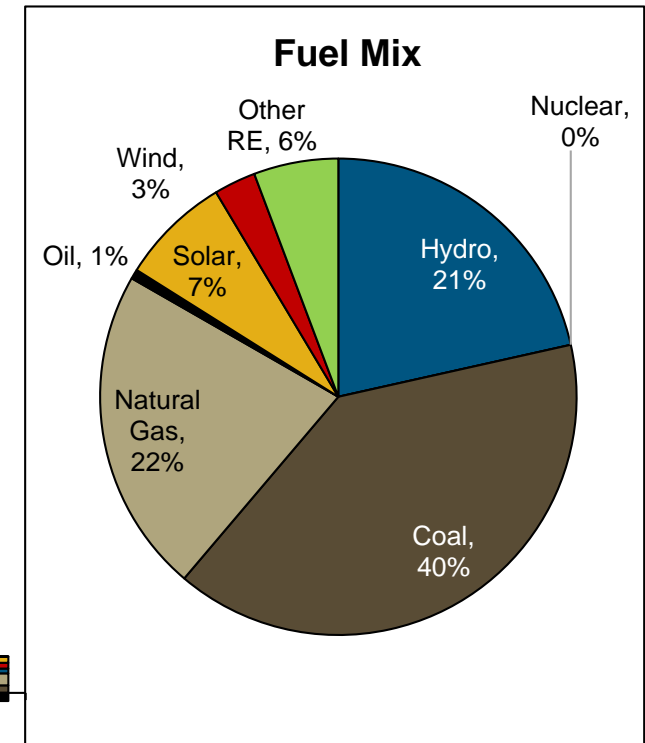
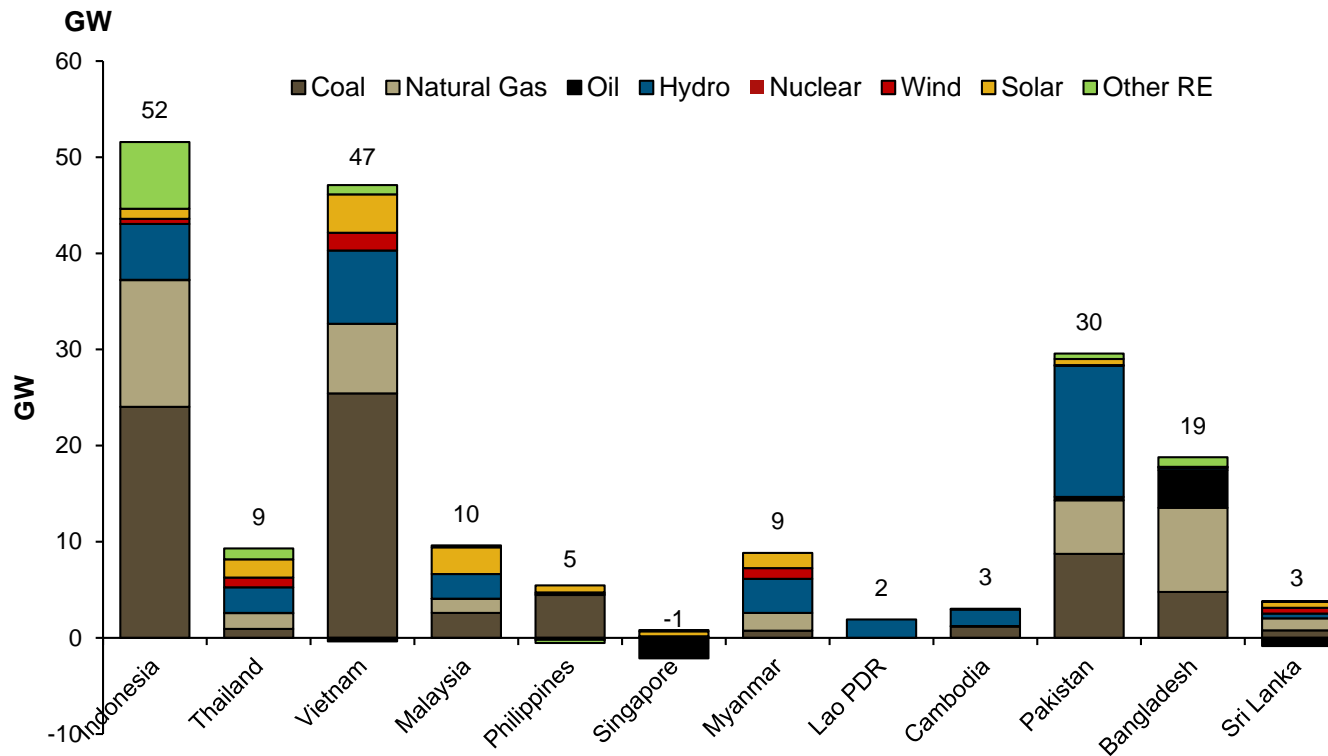
The current Power Supply Mix is heavily skewed towards fossil fuels



Solar & wind power < 2% of total generation capacity

And the current plans still have significant fossil fuel components

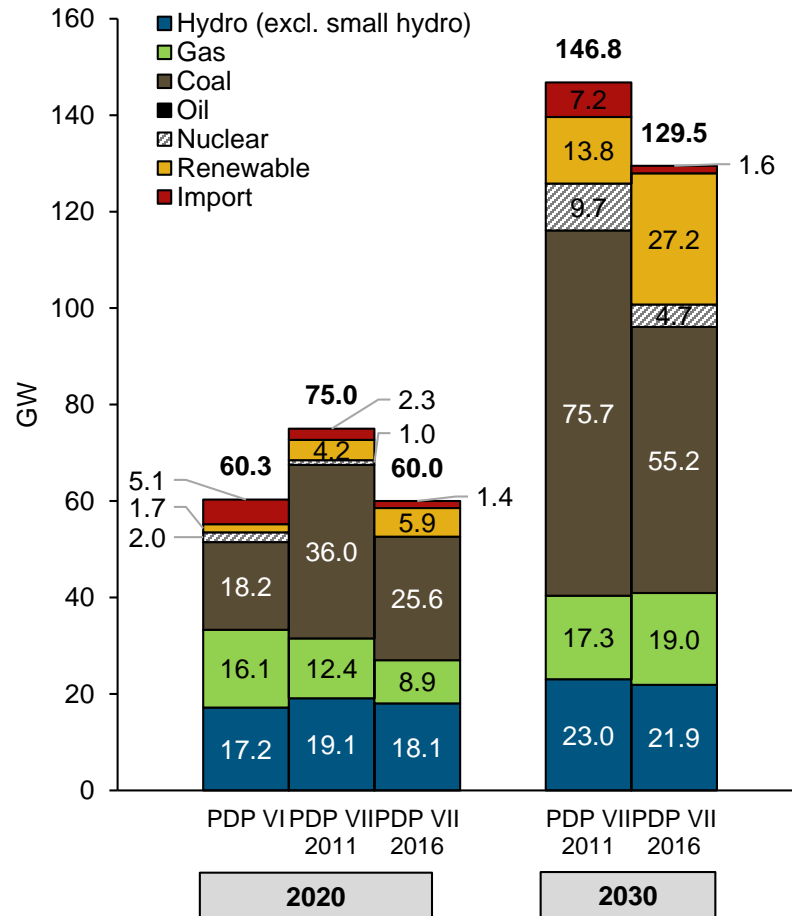
Planned and Projected Capacity Additions from Current to 2025



Coal and gas account for more than 60% of the planned installations between now and 2025

But the plans have been changing

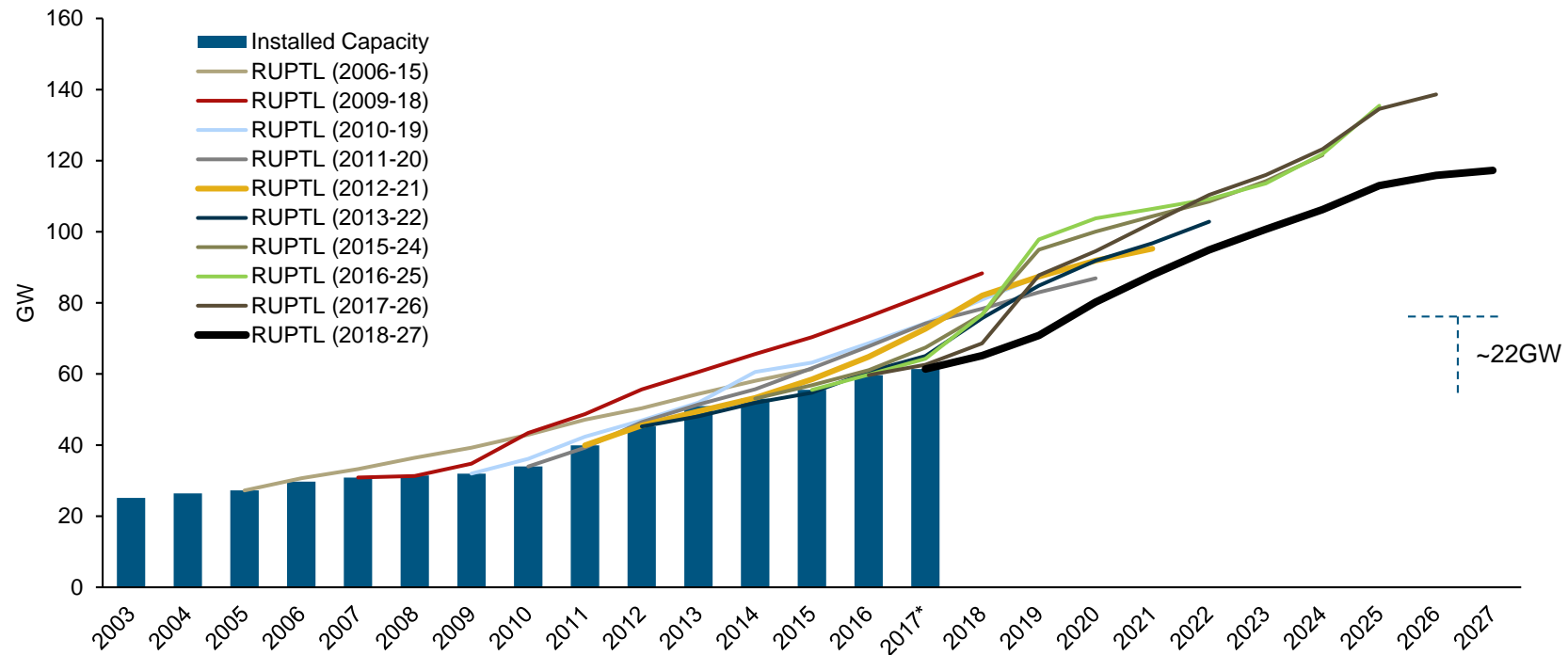
**Capacity Target Comparison between
PDP VII 2011 and PDP VII 2016**



Between the 2011 plan and the 2016 plan in Vietnam

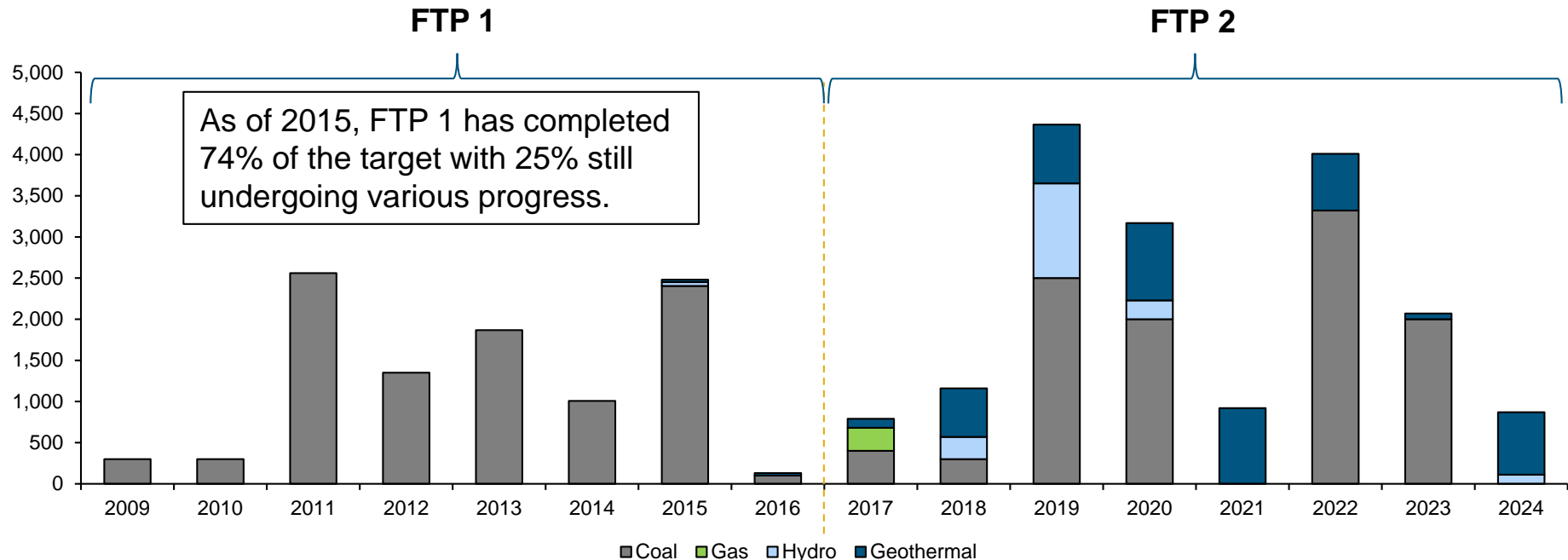
- The forecast of how much capacity was needed fell
- The forecast of how much of that capacity should be coal fell

Indonesia's history of setting ambitious targets for new build – in excess of demand growth – and then delaying plans, greatly complicates projections



The latest RUPTL canceled 22GW of capacity since the demand growth rate is slower than expected. The 22GW includes 10GW of gas projects, 6.6GW renewable projects and 5GW of coal projects.

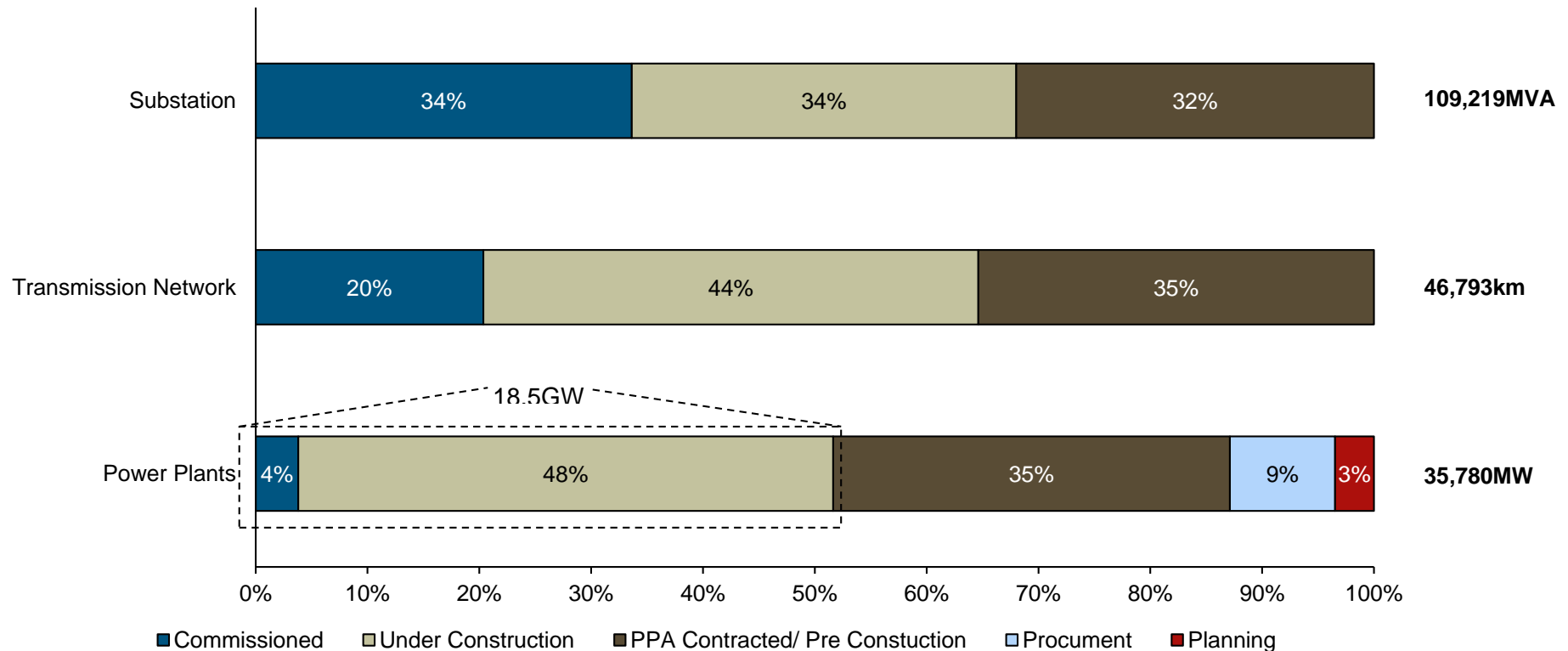
In Indonesia, Fast Track Programme 1 and 2 are good examples that demonstrate implementation delays commonly seen in Indonesia



- FTP 1 was proposed in 2006 to speed up Indonesia's generation capacity installation. FTP 1 planned to add 10GW of coal-fired plants between 2006-2009. However, FTP 1 has been subject to multiple delays. By 2015, FTP 1 has reached only 74% of the capacity that had been planned for 2009.
- FTP 2 was launched in 2009 to develop a further 18GW of capacity by 2016. FTP 2 included more coal, hydro, and geothermal capacity. FTP 2, however, includes very little new gas-fired capacity -- only 2% of the planned additions. FTP 2 has since been delayed, with only 55MW reaching COD through 2015.

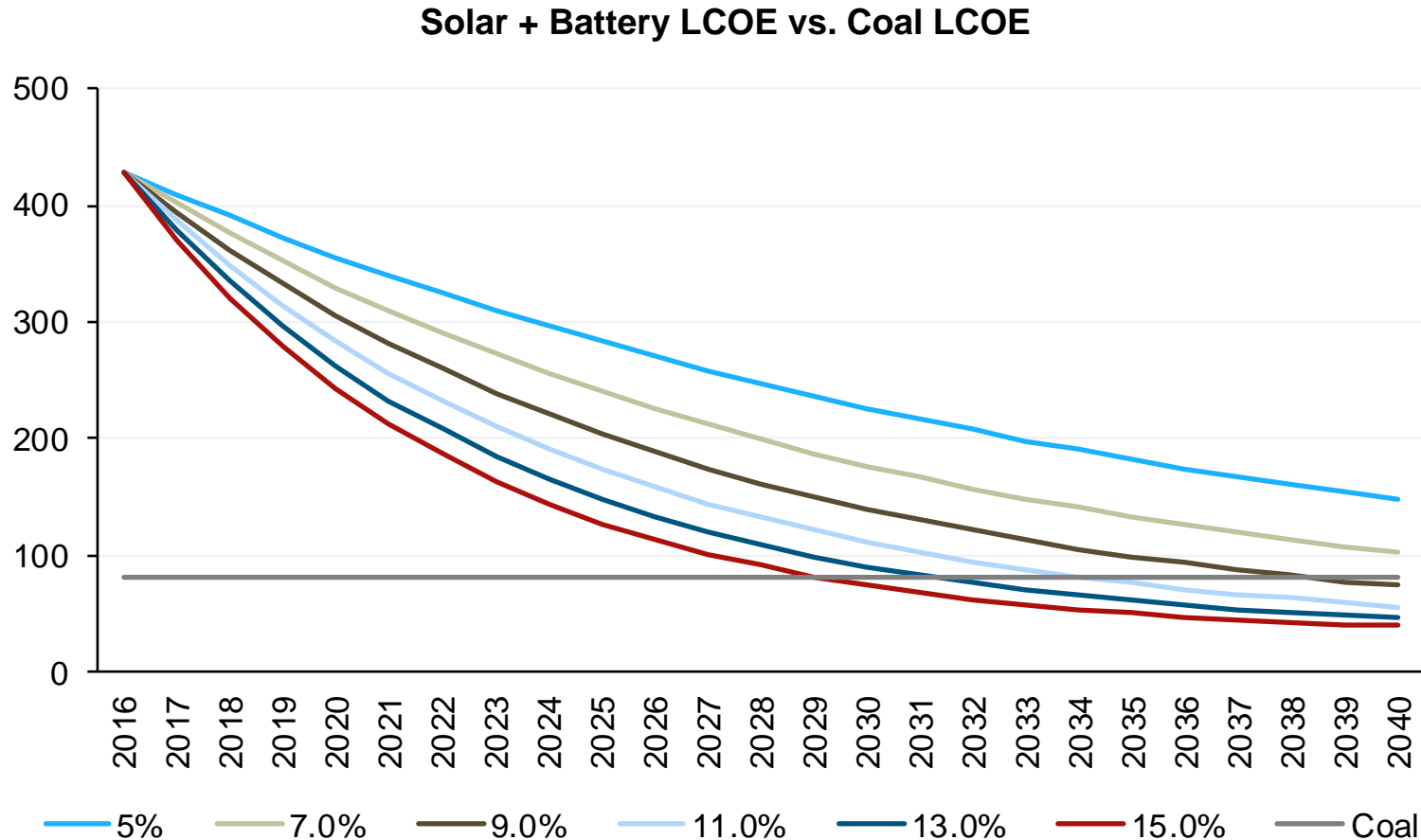
Indonesia: The target of 35,000MW Program will not be achieved by 2019

Status of 35,000MW Program as of January 2018



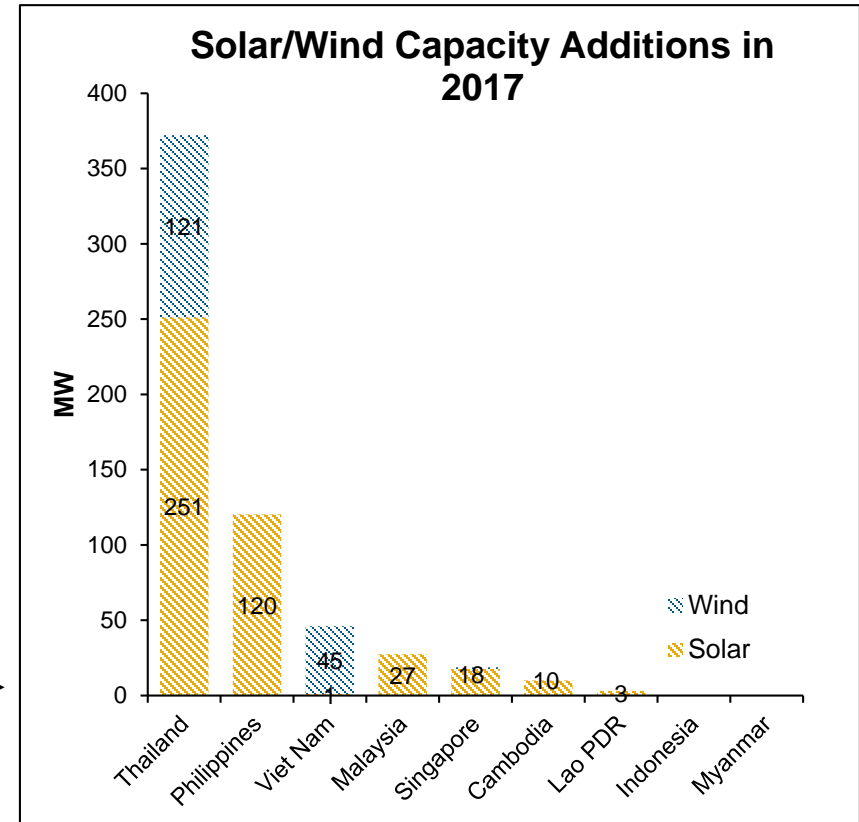
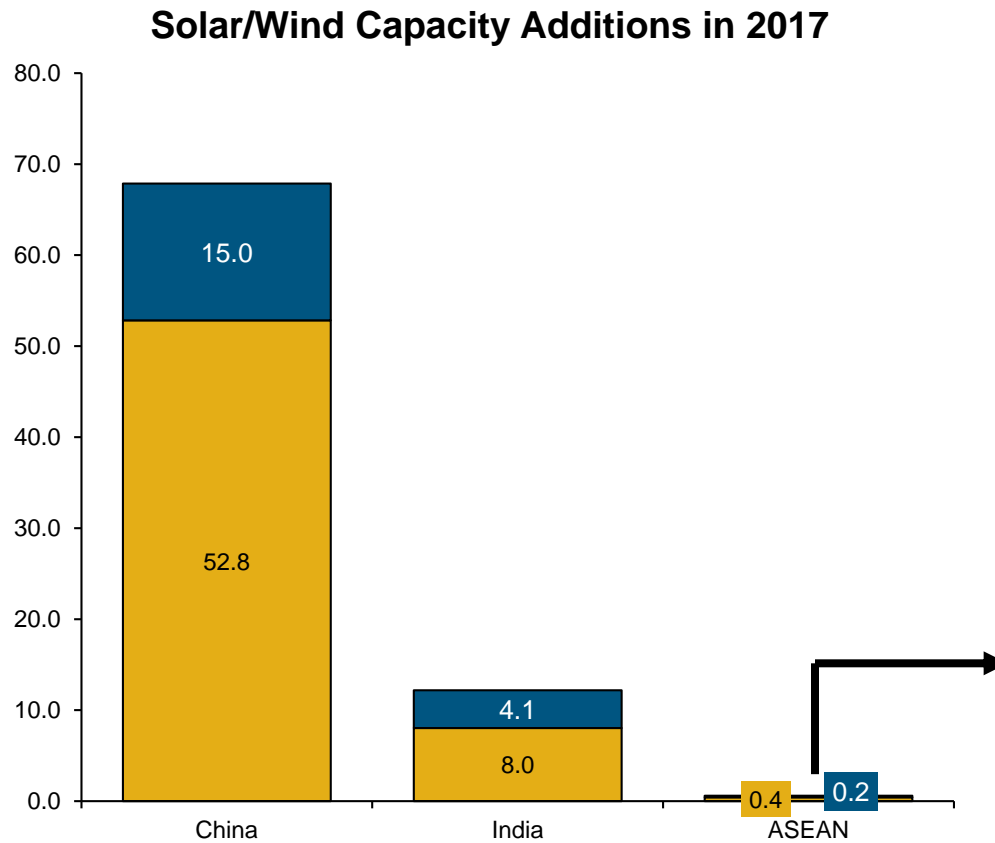
As of January 2018, only 4% capacity listed in the 35,000MW Program has come on line

Time is the enemy of coal fired projects



We do not know how fast solar and battery prices will fall, but we do know that at some point – probably within the economic life of a coal plant under planning today – they will outcompete it

Until now, ASEAN has lagged in development of renewables



China and India had record year in 2017 – up from 2016

That lag has mostly been attributed to an inadequate regulatory framework until now....

Malaysia – Regulatory leader

- FiT program phased out.
- Replaced by bidding and net metering
 - Auction 450MW (2016) / 460MW (2017)
 - Net metering 500 MW (2016-2020)
- But Limited transparency for long term and next step

Minor Mekong – No specific solar / wind regulations at all

- No FiT or developed RE schemes
- Negotiated ad hoc PPAs

Thailand – “If it isn’t broken – break it”

- Solar leader - But progress has stalled
- 2015-16 round of solar awards for <5MW projects using lucky draw
- 2017 tender focused on hybrids centered around biomass.
- Wind power was held up due to land issues, and only old development projects are implemented

Vietnam – Regulations slow in coming and flawed

- Wind FiT too low for many years
- No solar FiT / PPA before 2017
- RE PPAs not internationally financeable

Philippines – Leading the rest but still struggling

- FiT “one off” – No follow up quotas
- FiT quotas announced in 2014, filled up in 2015
- Developers without quotas sitting on ‘stranded’ development projects
- Bilateral PPAs signed, but don’t get ERC approvals

Indonesia – Constant regulation changes

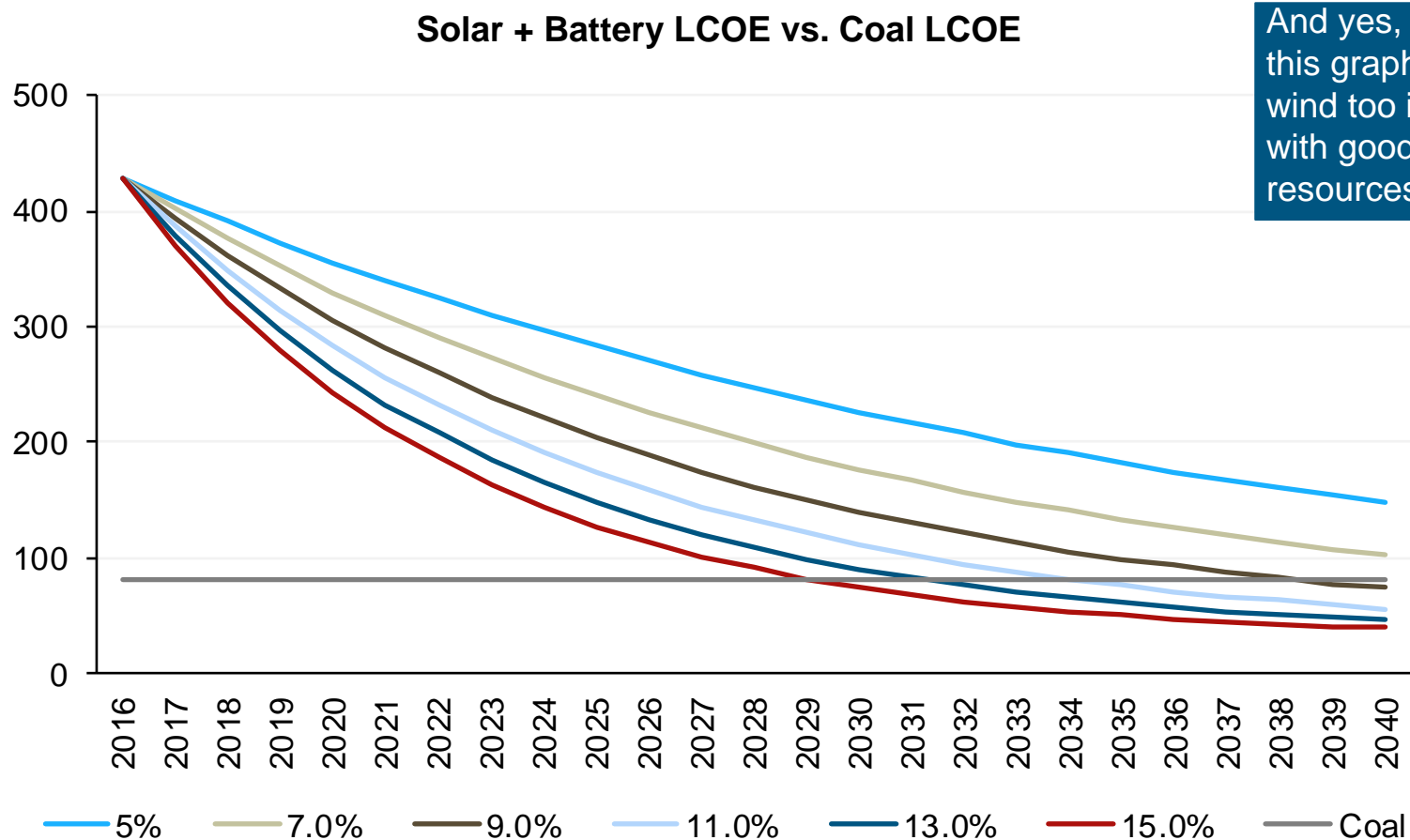
- No solar or wind projects in operation
- General PPA standards were revised 3-4 times in 2017 (and no official template PPA for solar and wind)
- First solar tender announced is still pending (after one year)
 - 2017 May: First tender announced – but still pending
 - H2 2018 first solar PPA signed
 - Negotiated wind PPAs used as template for solar

But that same inadequate regulatory framework also affects the development of fossil-fuelled plant

- Across much of Asia, “The Plan” (whether driven by the Government, regulator or key incumbent utility) is key to what projects are likely to be able to go ahead
- In Indonesia, delays are caused by red tape, problems from land acquisition, delay of permit acquisition, process of IPP procurement and the fact that PLN is not seen as a creditworthy off-taker – Letters of Guarantee are required from the Ministry of Finance, which have to be changed each time there is a change in the PPA
 - The effect of delays have been two-fold; unserved load has remained unserved, while the revised capacity mix shifts to more CCGT capacity which can be developed more quickly on PLN’s existing sites – particularly on Java
- In Vietnam, it still takes something like 10 years to develop a project for similar reasons to Indonesia. Further, it is hard to gain consensus because of the large number of parties who have to agree to any proposal. Plans for LNG terminals are struggling with delays as well due to the lack of a regulatory framework
- Even in the Philippines, one of few “un-planned” systems, ERC chaos has delayed a significant number of coal projects (as well as some solar projects)

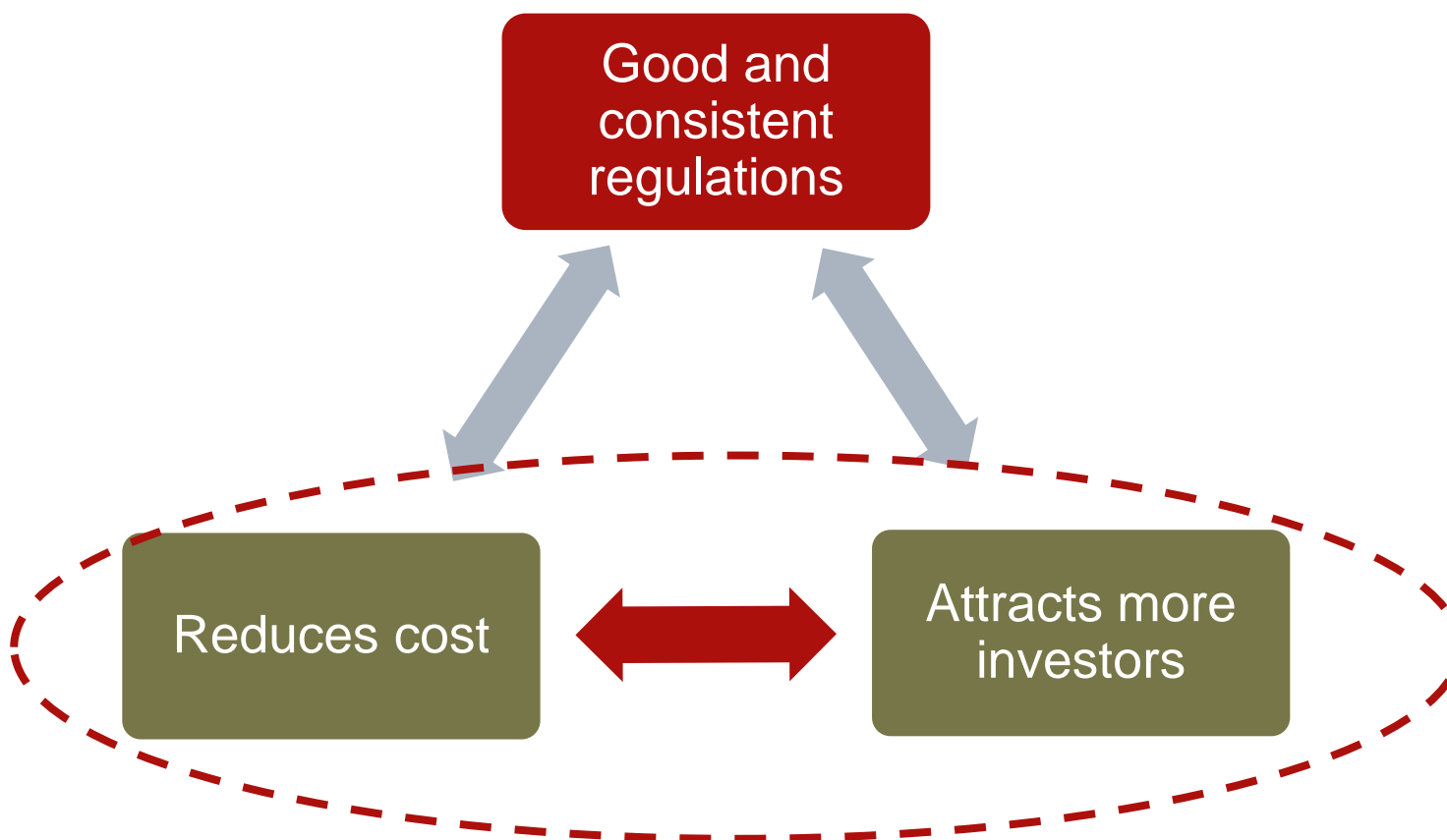
In the absence of well functioning commercially driven markets, policy and regulation remain key in Asia

And I repeat.....Time is the enemy of coal fired projects!



Who will build a project if they are not sure if it will remain economic unless the regulatory environment gives them solid protection?

Policy and Regulations drive investment in many of the Asian markets (Even places with a notionally private sector market like Philippines)



In theory therefore, look for places with the best, clearest and fairest regulations
(But Singapore doesn't have much more room!)

What about gas?

Key drivers of gas-to-power in SE Asia

Economic Fundamentals

- GDP and power demand is expected to grow fast, and substantial amount of timely built new capacity will be needed to meet the demand growth
- Gas may be the most economically robust fuel choice for mid-merit and peaking generation in the changing power industry

Gas Infrastructure

- Many countries have plans to build new LNG terminals, but some countries such as the Philippines and Vietnam have challenges and barriers to overcome
- There are more discussions on small scale LNG, but it is still at a very early stage of development

Policy and Regulations

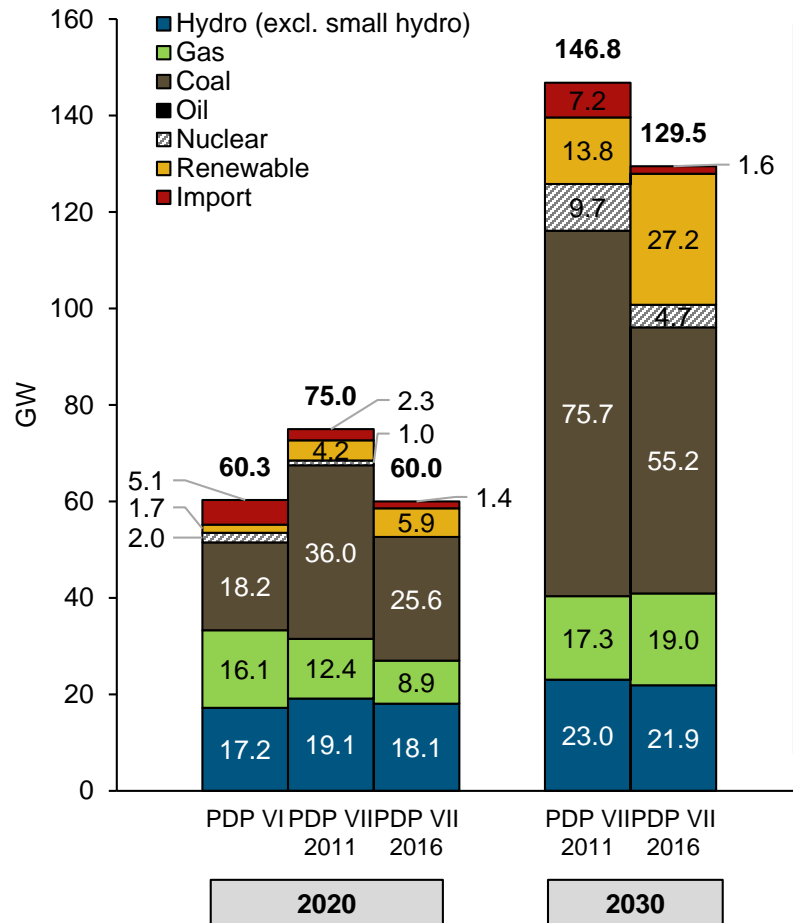
- Governments have shifted their policies to be more focusing on energy security and environmental sustainability
- Latest government plans show that gas/LNG will continue to play a critical role, but its share will be squeezed by solar and more coal plants

Gas projects have more potential...

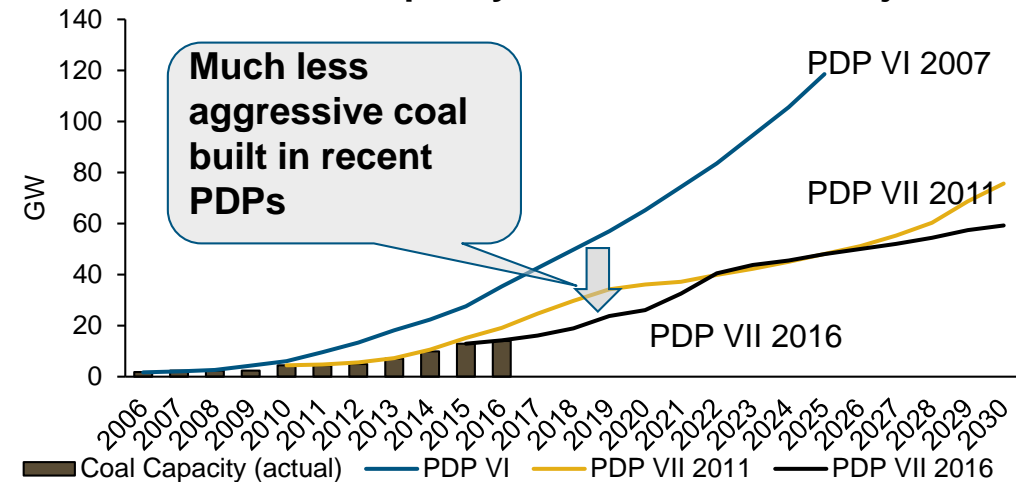
- Gas fired power station are typically faster to build (which is good if you are racing against falling renewable costs)
- More environmentally friendly than coal (so less opposition to your project)
- And flexible – meaning they can mitigate risks of coal delay and solar intermittency
- Flexibility is also important commercially in an environment where future relative technology costs are uncertain

For example – in Vietnam LNG can address domestic gas resource decline and mitigate the risks of coal delays and solar intermittency

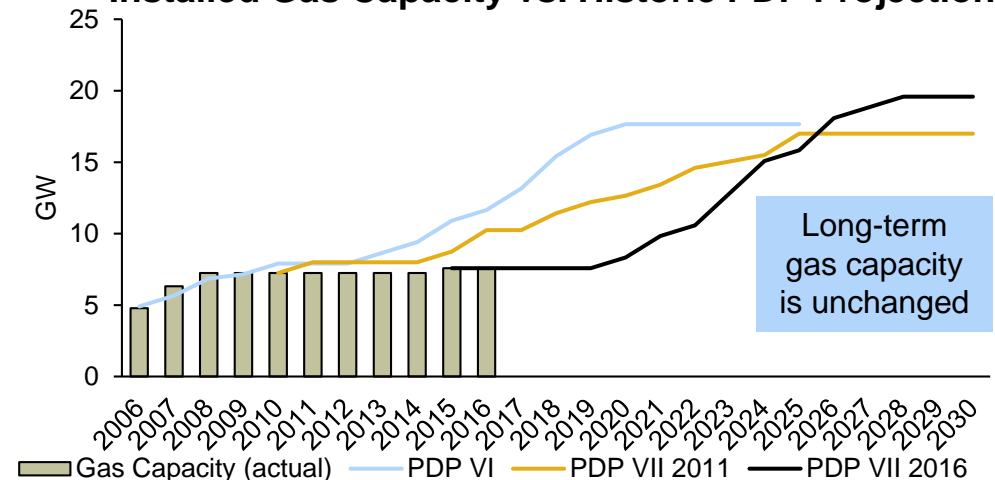
Capacity Target Comparison Between PDP VII 2011 and PDP VII 2016



Installed Coal Capacity vs. Historic PDP Projection

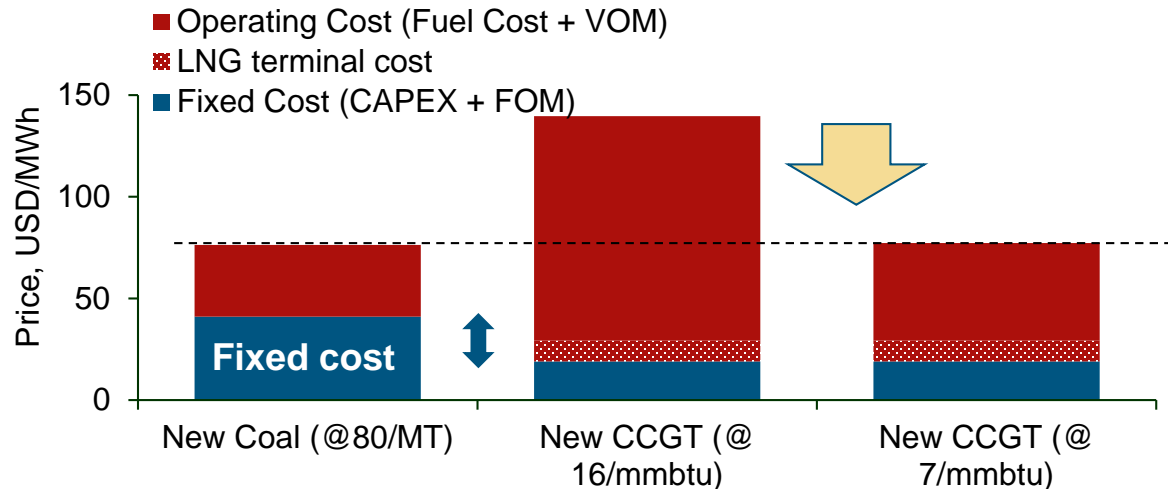


Installed Gas Capacity vs. Historic PDP Projection



Economics of gas-fired *capacity* is fairly robust to fuel price fluctuations as long as gas is available flexibly

New Coal vs New Gas in ASEAN @ 75% Capacity Factor



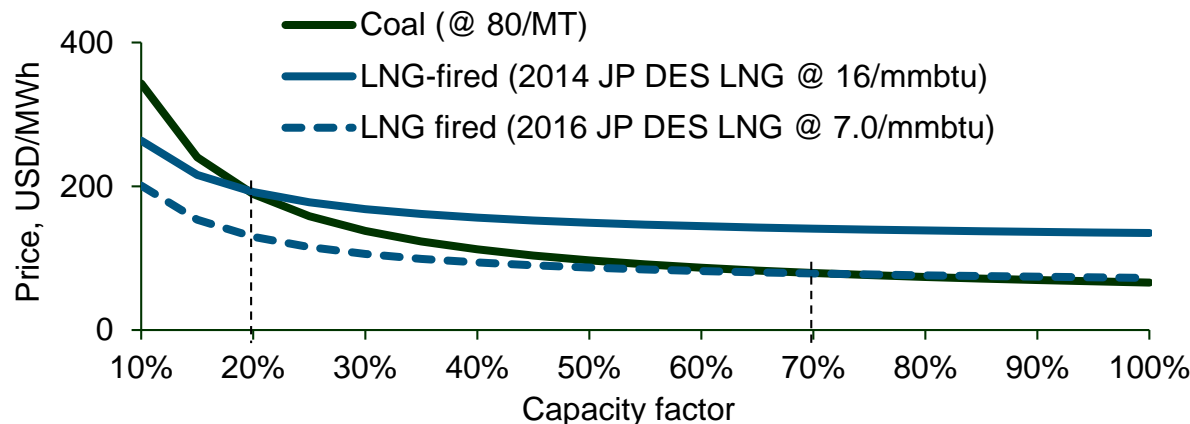
- Basic characteristics of coal vs gas
 - Coal – high CAPEX, low fuel price
 - CCGT – low CAPEX, high fuel price
- **Gas always has a role for mid-merit or peaking**

Coal *capacity* value is **vulnerable** at lower utilisation due to higher capital costs relative to gas.

Gas *capacity* value is **robust** at lower utilisation unless *committed to take too much gas*

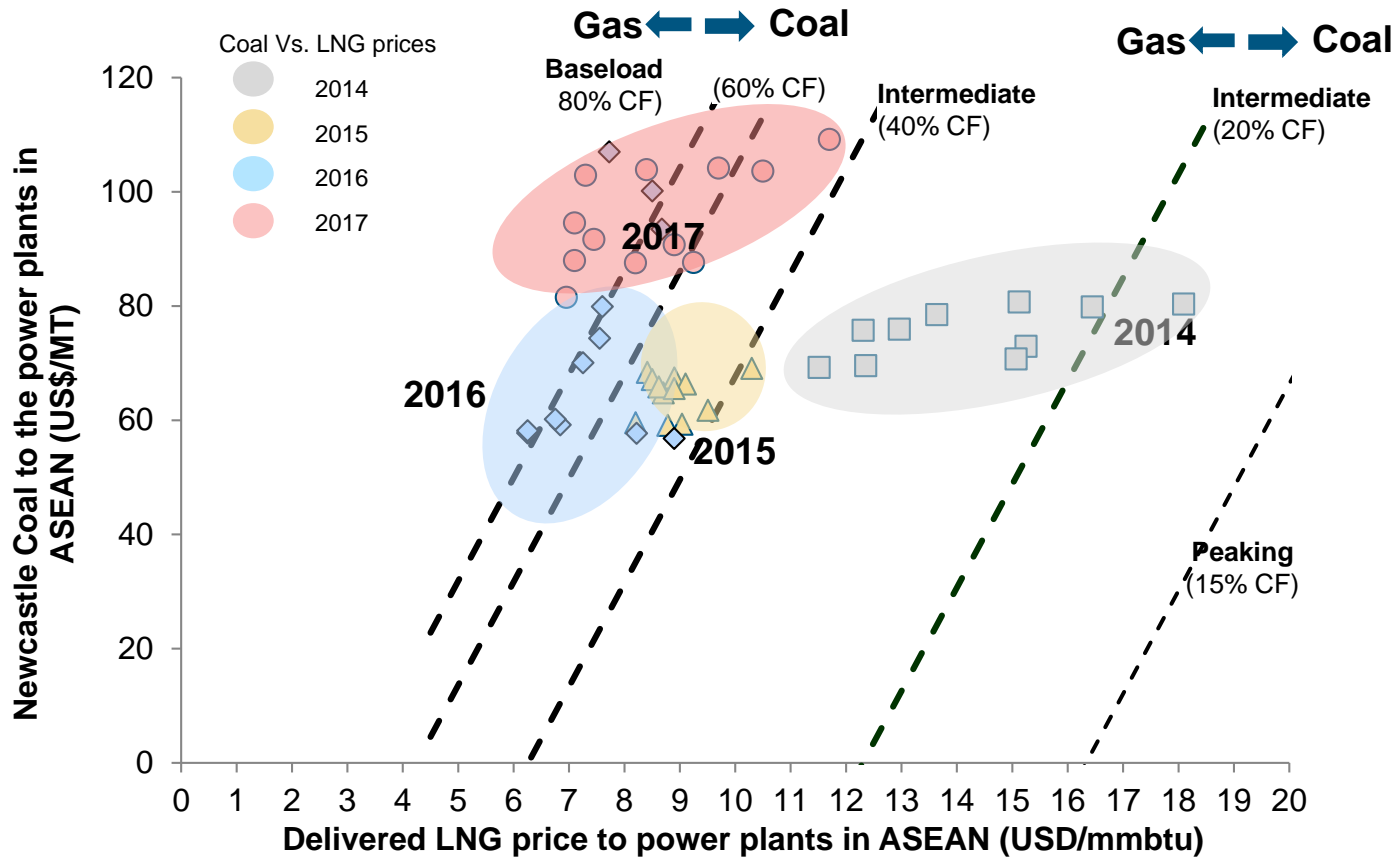
The amount of gas that is optimal swings wildly with changes in fuel costs. Gas is currently lower cost

Screening Curves of coal vs gas



Fuel competition: Coal expected to dominate due to low cost but gas is economic as mid-merit generation fuel

Coal-to-LNG Strategic Switching in Power Sector for New Investment



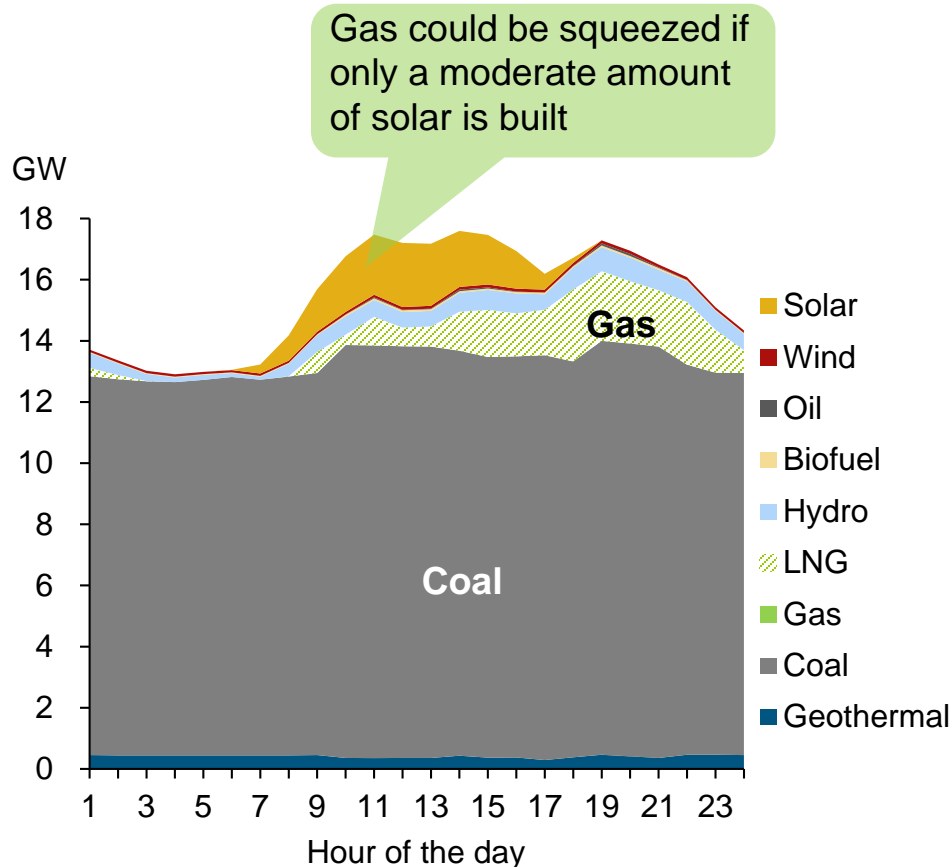
- Coal-to-LNG switching is possible at gas prices to the power plants below \$7.5/mmmbtu
- Higher gas breakeven prices is possible considering increasing coal development cost (including EPC coal handling facilities, and higher financing costs for greenfield coal projects)
- However, it is likely that blended gas prices will rise above the breakeven cost of coal due to increasing share of market-based priced LNG (which could be USD 8.5-11/mmmbtu)

Note: Key assumption: LNG regas and associated pipeline tariff to the power plants is US\$1.5/mmmbtu and coal transportation cost is US\$ 7/metric tonnes; capital cost coal US\$1,800/kW gas CCGT US\$800/kW; HHV net heat-rate coal 9.5 GJ/MWh, gas CCGT 7.2 GJ/MWh, FOM is USD 40/kw-year for coal and USD 23/kw-year for gas, VOM of coal is 2.5/MWh for coal and USD 1.0/MWh for gas. WACC is 12 percent.

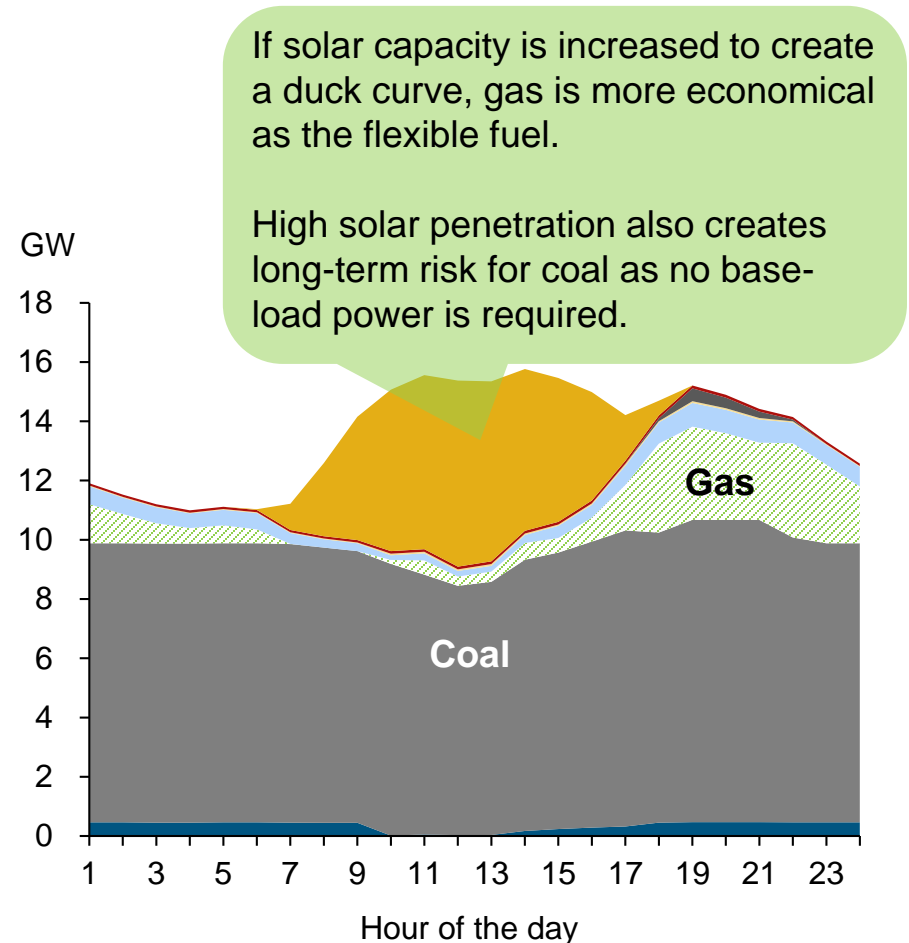
Source: TLG

Gas can be compatible with solar, especially under the possible scenario that solar expansion is aggressive in the very long term

Reference Case in Luzon (2040)

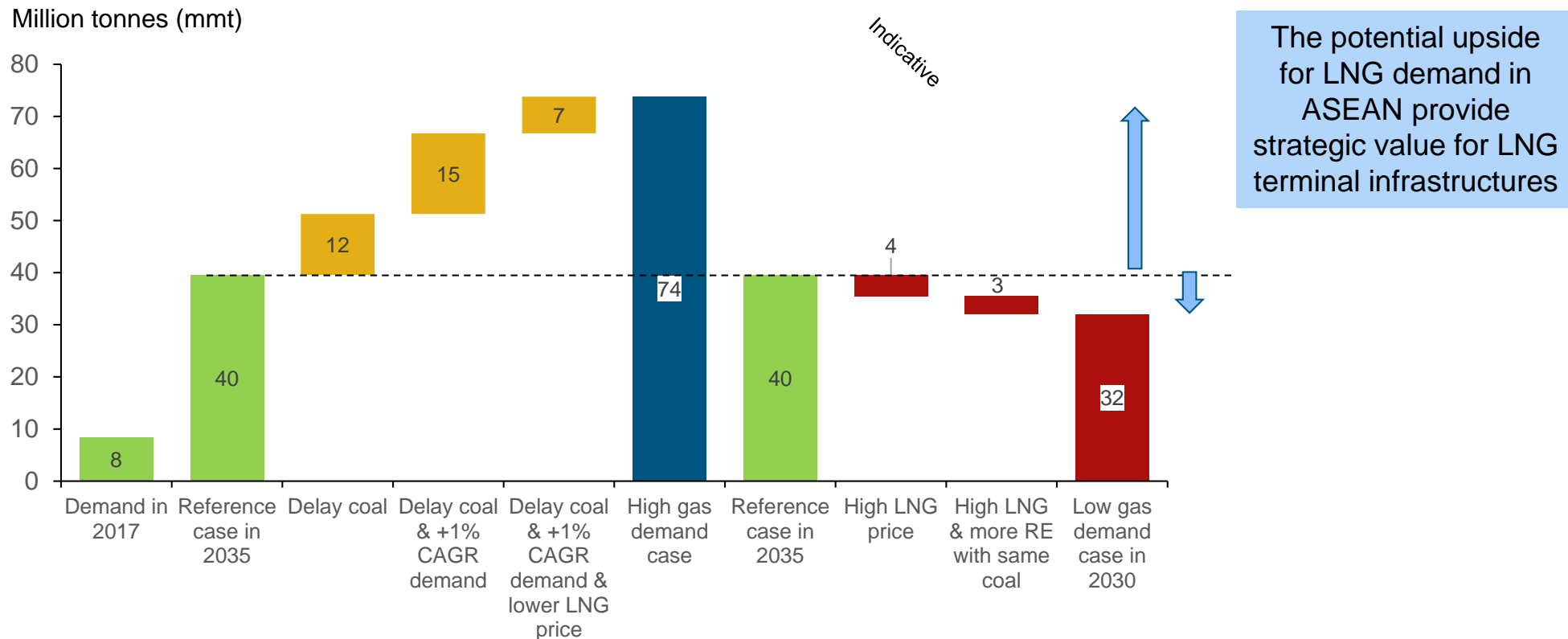


Aggressive Solar Entry Case in Luzon (2040)



LNG is likely to be used as the swing fuel to meet more gas demand, and its potential range of LNG demand is large

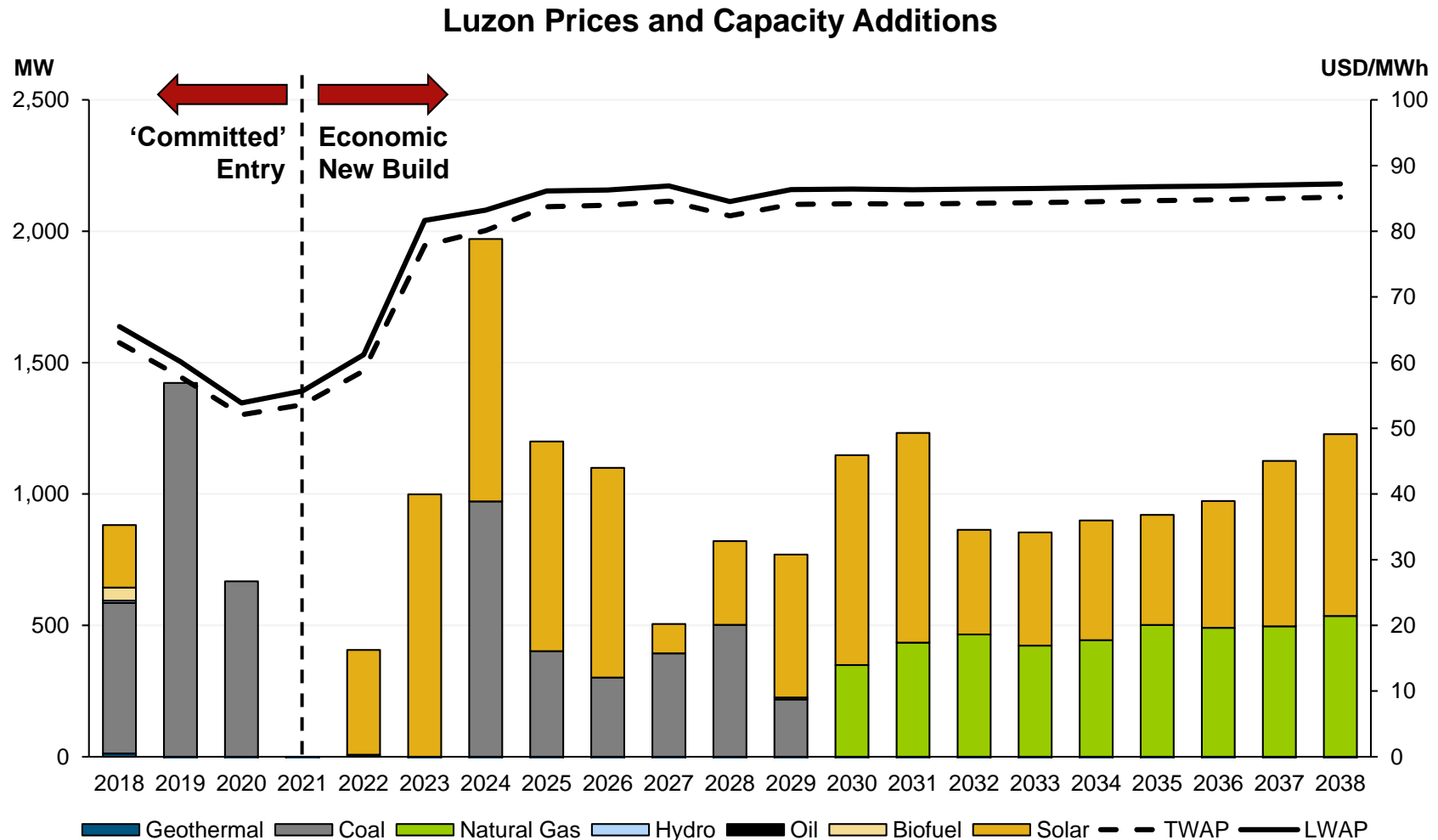
LNG Import in ASEAN in 2035



Note: LNG import does not include those are traded within the country

For delay coal scenario, amount of reduced coal built is assumed to be 3.6 GW (30%) in Philippines, 1 GW (40%) in Thailand, 7.2 GW (10%) in Vietnam, 7.2 GW (15%) in Indonesia for the period of 2018-2035. Lower LNG price scenario means that the LNG price is USD 1/mmbtu less than the reference case (averaging 9.5/mmbtu to the power plants). Higher LNG price scenario assumes it is USD2/mmbtu more than the reference case. Under more RE case, the additional annual solar addition is 100 MW in Singapore, 200 MW in the Philippines, Thailand, Vietnam, Indonesia and Malaysia for the period of 2019-2035

Philippines being a more commercially driven market is a leading indicator of what might out-turn in Asia – the fuel mix is a mix and evolves over time



The future is an evolving mix

Now and near-term

Coal remains the cheapest form of baseload power today, but gas and LNG are competitive from time to time depending on global fuel prices and RE (plus storage) will out-compete coal for baseload in the long term

Coal projects need robust regulations to deal with the threats from gas and renewables

But mostly, coal projects just need to get built - as fast as possible.

Moving forward

Gas is the intermediate fuel – good for intermediate operation, good for the intermediate time period, good to fit into a portfolio of other technologies

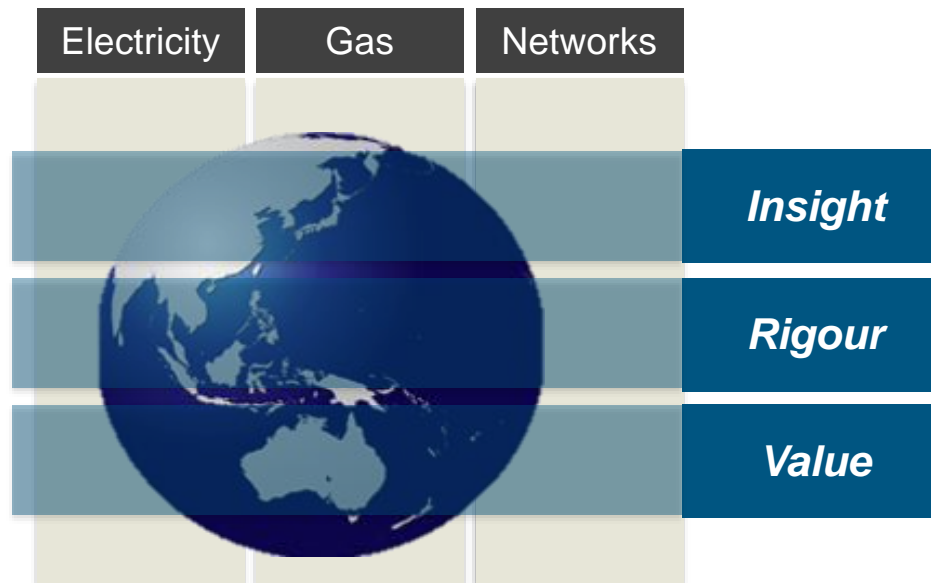
But gas still remains challenging commercially, given the high fixed costs of LNG infrastructure and the difficulties of finding the right LNG procurement deal

The Future

The future?

In the long term the future belongs to the renewables, the consumers and the technologies yet to evolve

Thank you



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